

REMARKS/ARGUMENTS

This Amendment is filed with an RCE.

Support for the amendment can be found in the following passages from the application, but is not limited to these sections:

[0010] Once the liquid media (i.e., `resin`) is pulled (i.e., flows) into the preform, we have observed that the single bag tends to relax behind the wave front (i.e., the foremost portion of the resin that is moving into the preform within the bag). When the flow media is full or partially full of resin, we believe that the bag slowly relaxes and moves away from the flow media presumably because the flow path of least resistance becomes a path over the flow media between the flow media and the overlying bag. Relaxation increases the enclosed volume around the preform, which becomes filled with resin. The farther away from the leading edge of the wave front, the more the bag tends to relax. We have observed that the composite in areas where the bag has relaxed can have lower fiber volume, poor fiber volume control, and lower mechanical properties than desired, because excess resin has filled the enlarged volume. The bag relaxation can produce a change in the intended thickness of the composite, so that in localized areas where relaxation has occurred the composite is thicker than intended.

[0011] Our preferred double bag vacuum infusion process circumvents the Seemann (single bag) problems in that the inner and outer vacuum bags independently control the resin feed. The double bag provides a caul effect. The bleeder and breather sections are completely isolated. With this approach, the bag is never able to relax behind the wave front and the resulting composites have higher fiber volumes on average (with more precise control) and have uniform thickness with constant thickness preforms. Our process eliminates the bag relaxation defects we observed with the Seemann process.

[0012] During relaxation, we observe that resin pools inside the bag. Pressing on the pool, we feel a soft, spongy, loose area different from the feel where relaxation is not occurring. The bag stretches and the volume under the bag increases. In circumstances of relaxation, we have observed that pressurizing the resin feed above atmospheric increases the relaxation, so the phenomenon appears to be tied to the pressure differential and the driving force for resin flow, as we would expect. Adding a second vacuum bag (separated from the first bag with a breather) makes it harder for the "double bag" to relax. Therefore, we can use a higher differential pressure to move the resin than might best be employed with a single bag. The "double bag" becomes a means to reduce flow over the filled flow media because the vacuum bag effectively is thicker. The "double bag" also provides increased vacuum integrity because it provides a redundant, second bag to counter any leaks in the first bag.

[0033] We can infuse faster or can use more viscous resins because of the larger driving force.

[0015] Our preferred `double bag` process allows fiber volume percentage or fraction in the composite to be increased 5-10% higher than we have been able to achieve with the single bag technologies of Seemann and Palmer.

[0016] In any vacuum impregnation process, vacuum integrity is essential to produce high quality composites consistently. Leaks in the bagging seals, resin ports, or vacuum ports will permit air to enter into the bag. Air causes the preforms to swell and reduces the fiber volume fraction by increasing the spacing between fibers. Composites made with leaking bags will typically have one of more of the following problems: high void content, surface porosity, low fiber volumes, or excessive thickness. Parts often need to be scrapped; they cannot be repaired.

[0153] The inner bag vacuum level should equal or exceed the vacuum level between the inner and outer bags so that a pressure is exerted on the inner bag from the chamber defined by the inner and outer bags. This situation occurs naturally when both the inner and outer bags are connected to the same vacuum source. If the outer bag vacuum level exceeds the inner bag vacuum level, the inner bag can be slightly displaced with less effective compaction of the preform.

None of the prior art cited by the examiner has two separate vacuum chambers.

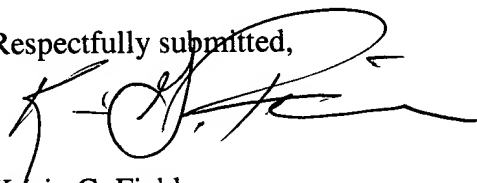
Appl. No.: 09/731,945
Amdt. dated 04/24/2006
Amendment submitted with RCE under 37 C.F.R. § 1.114

CONCLUSION

In view of the amendments to the claims, and the remarks presented above, Applicant respectfully submits that the present application is in condition for allowance. As such, the issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite the examination of the present application, the Examiner is encouraged to contact Applicant's undersigned attorney in order to resolve any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 18-1730.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Kevin G. Fields', written over a horizontal line.

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